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UNDERGROUND TRIALS OF A SYSTEM FOR PRELOADING WOODEN CHOCKS

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April 1987

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15 pp

MICROMEDIA

COAL RESEARCH LABORATORIES
DIVISION REPORT CRL 87-42(TR)

87-05164/

UNDERGROUND TRIALS OF A SYSTEM FOR PRELOADING WOODEN CHOCKS

by

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ABSTRACT

This report gives details of a short underground trial of a system of preloading wooden chocks at the time of construction. If followed through to regular underground use, the system would improve strata control at the face ends at Lingan Colliery.

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ESSAIS SOUTERRAINS D'UN SYSTÈME DE PRÉCHARGEMENT DE PILES DE BOIS

par

P. Cain*

RÉSUMÉ

Le présent rapport décrit les détails du court essai souterrain d'un système de préchargement de piles de bois au moment de la construction. L'emploi de ce système au cours de l'exploitation minière souterraine pourrait améliorer le contrôle des strates des fronts de taille de la houillère Lingan.

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INTRODUCTION

Wooden chocks or cribs are widely used underground in the Sydney Coalfield in gateroad packs or as temporary support under brushings and on facelines during face equipment withdrawal. They are constructed from hardwood blocks in skeleton form - two or three blocks per layer - or in solid form. Two block sizes are commonly used, 15 cm x 15 cm x 152 cm and 15 cm x 15 cm x 76 cm (6" x 6" x 60" and 6" x 6" x 30"), and hardwood wedges are driven between the tiers to ensure good contact between the chock and the roof.

Despite the advantages of wooden chocks - ease of construction and ultimate support capacity - they are a passive support requiring substantial closure in order to generate load in the chock. In many circumstances, for example in wide openings under a fissile roof strata, passive supports will allow the roof to lower beyond its capacity to remain stable. A compounding problem is the setting of wooden chocks on loose dirt. The loose dirt must be compacted before the chock can accept load and fully support the roof.

An ideal solution to these problems would be to preload the chocks. Some preloading is accomplished whilst wedging the chock to the roof. In South Africa it was possible to preload chocks to 8.2 kPa (1.2 psi) in this way (1), but the setting load decays as creep occurs in the timber (2).

An alternative method of preloading the wooden chocks has been used in the Lorraine Coalfield in France (3). An air lifting bag, similar to that used by rescue services, is placed on top of the partially completed chock and inflated. This preloads the chock and construction can be completed. When the air bag is deflated, the chock retains the preloading, and offers immediate support to the roof.

In the 6W panel at Lingan Colliery, considerable difficulty is experienced in maintaining good conditions at the brushing lips. These poor conditions are due to the presence of a parting plane approximately 1 m above the seam. The chocks installed to control the roof between the faceline and the brushing allow too much yield. The strata breaks along the parting plane and makes the brushing lip dangerous and difficult to control.

At the request of the mine manager, the author arranged a trial of the air bag method of preloading the wooden chocks. This trial and the results obtained are described below.

TRIAL DETAILS

The trial was conducted at the 6W material level brushing lip. There was not enough space to build a chock specially for the trial, so an existing chock built eight hours earlier on the previous shift was used. The chock was dismantled by inserting and inflating a 51 cm x 51 cm (20" x 20") air bag between the chock and the roof. This loosened the top layer of the chock sufficiently to allow it to be removed easily. Three extra blocks were added to the top layer (Figure 1) to increase the bag bearing area. A load cell and four strain measuring stations were set up (see Figure 1), and the air bag laid flat on the top layer. Two air bag sizes were tried, 51 cm x 51 cm (20" x 20") and 61 cm x 61 cm (24" x 24"). Load cell and strain measurements were taken initially and after inflating each air bag on the chock. Finally the 20" x 20" air bag was inflated on the chock, and the chock was then completed and the air bag released. Final chock load was measured.

The air bags were inflated to 100 psi from the mine compressed air range through a regulator. A photographic record of the trial is shown in Appendix A.

TRIAL RESULTS

The trial results are given in Table 1 below:

Table 1 - Trial results

	Air bags inflated to 100 psi			
	Strain	Cell Pressure (Mpa)	Chock Stress (MPa)	Chock Load (tonnes)
Initial readng	0	0	0	0
Inflate small air bag	0.48%	0.87	0.14	8.8
Deflate small air bag	0.16%	0	0	0
Inflate both air bags	0.69%	2.1	0.3	18.7
Inflate small air bag	ND	0.87	0.14	8.8
Complete chock				
Deflate air bag	ND	0.35	0.06	3.8

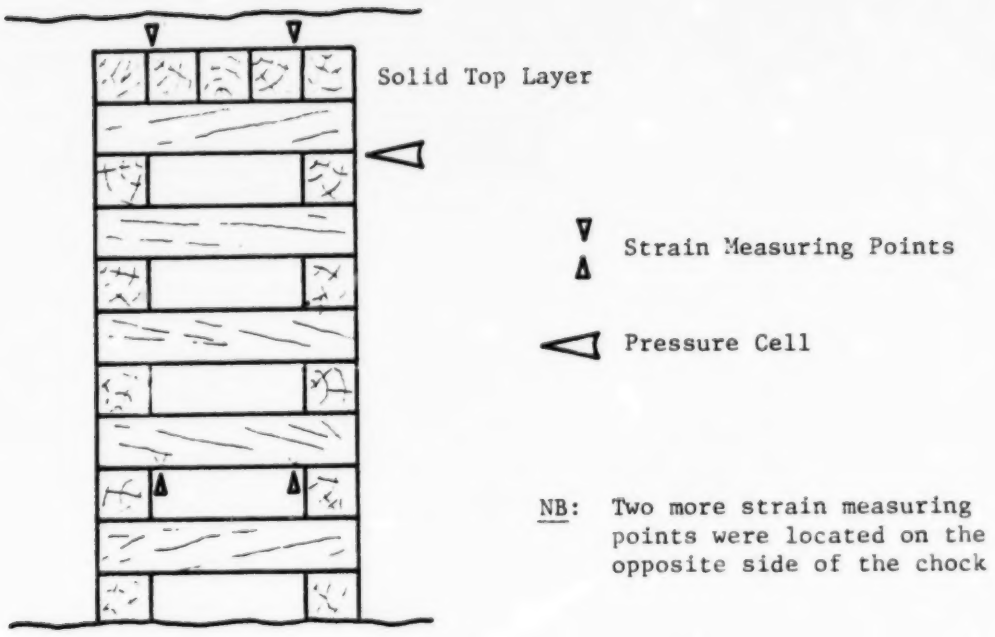
Solid Top Layer
Strain Measuring Points
Pressure Cell
NB: Two more strain measuring points were located on the opposite side of the chock

Figure 1 - Construction of trial chock showing location of measuring stations

DISCUSSION

The fact that the chock could be dismantled by inflating an air bag demonstrates that even after 8 hours chock loading was below the 8.8 tonnes recorded later in the trial, indicating the possible benefits of preloading.

It was anticipated before the trial that higher strains would be recorded. The low strains actually measured could be due to the use of a preconstructed chock. The floor material on which the chock was built, and the timber itself, would be already compacted at the time of the trial.

The final chock stress is equivalent to 60 kPa, a nearly eight times more preload than that obtained in South Africa by wedging. An air bag size more suitable to the size of the chock, i.e. 38 cm x 106 cm (15" x 42") would provide a larger bearing surface and hence more preloading capacity.

Preloading will also be increased if the distance between the top tier of the chock and the roof is kept to a minimum. As the air bags inflate, they tend to become spherical if not constrained, and the bearing surface decreases. Use of the suggested air bag size could provide a theoretical chock preload of 20 tonnes, considerably improving the support capabilities of this type of support. If two air bags are used and inflated simultaneously, the contact area, and hence the preloading, is increased.

CONCLUSIONS AND RECOMMENDATIONS

The trial, brief though it was, conclusively showed that the use of an air bag resulted in a substantial preloading of the chock. Additional preloading could be obtained by the use of a 38 cm x 106 cm (15" x 42") air bag, and by ensuring a small gap between the two bearing surfaces to allow the full loading effect to be achieved. Although in the trial the air bag was placed between the top of the chock and the roof, a better preloading effect could be achieved by modifying chock construction to allow the air bag to be placed in the middle of the chock. The recommended method of chock construction and preloading is illustrated and described in Appendix B.

It is recommended that CBDC purchase two of the 38 cm x 106 cm (15" x 42") size, plus hoses and a regulator, and obtain permission from Labour Canada for their use underground in an extended trial. It is

anticipated that such a trial will demonstrate a marked improvement in the control of the brushing lips, particularly in fissile ground, at which point a wider use for the system can be implemented.

ACKNOWLEDGEMENTS

The author would like to acknowledge the assistance of Mr. Walter Wilson of Mic Mac Fire and Safety, Dartmouth, Nova Scotia in conducting the trial, and the workers and management at Lingan Colliery for their interest and participation.

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APPENDIX A

Photographic Record

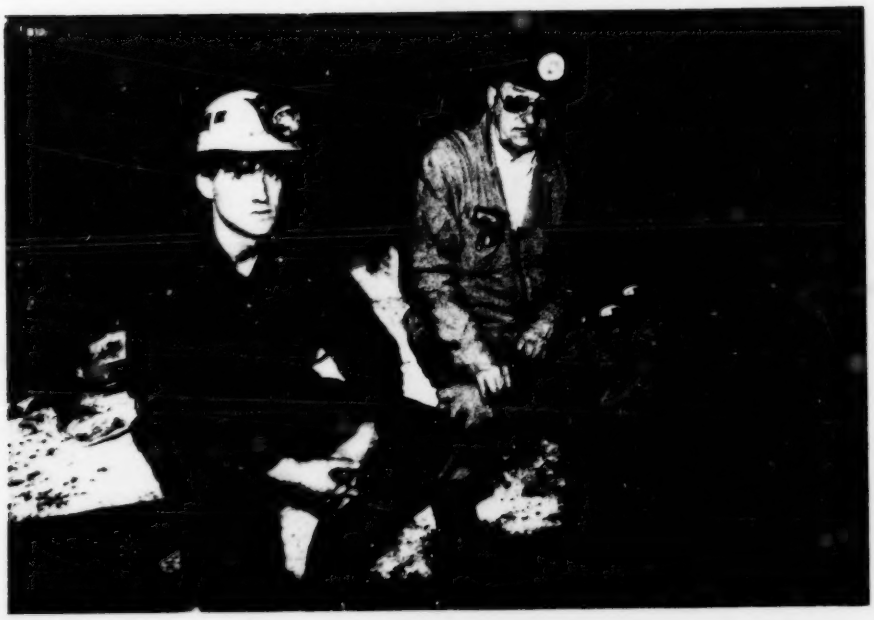

Photo 1 - Mr. E. Parsons and Mr. W. Wilson (l-r) showing the air pressure regulator

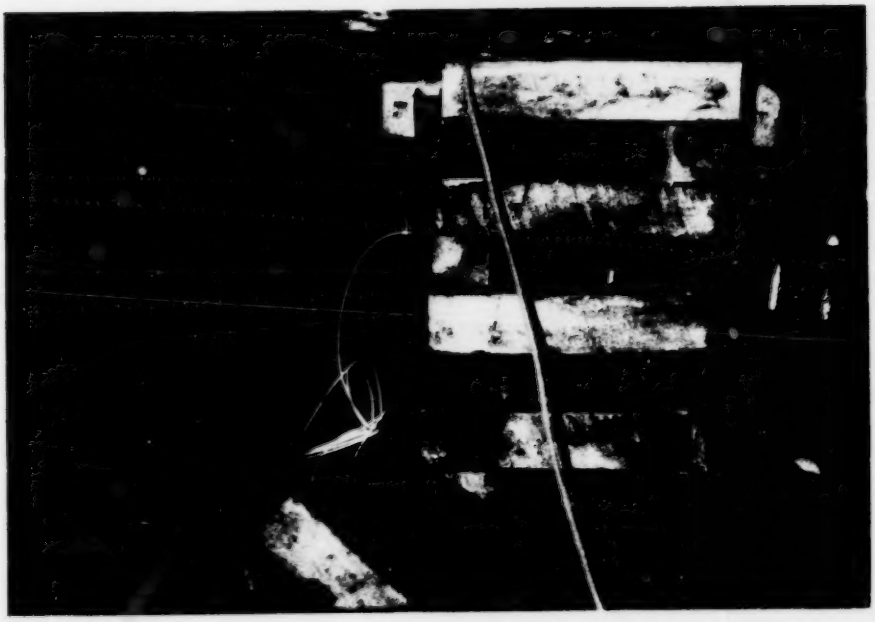

Photo 2 - Trial chock showing air bag in place prior to inflation and the load cell in position

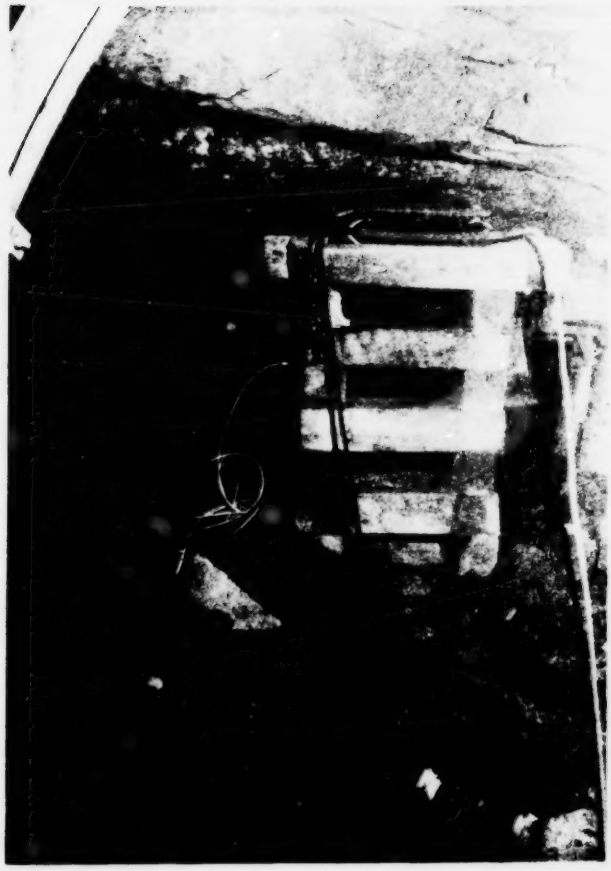

Photo 3 - Trial chock with both air bags inflated

Photo 4 - Trial chock with single air bag inflated

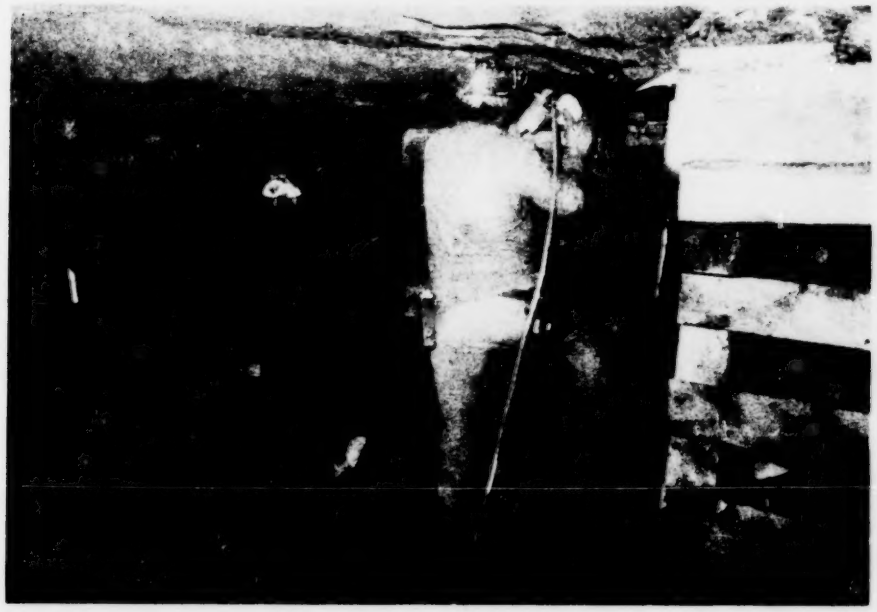

Photo 5 - Finishing off chock construction
with inflated air bag still in place

APPENDIX B

Recommended Preloading Procedure

1) Construct the chock according to the pattern shown in Figure B1.
2) Insert two air bags between the two solid layers.
3) Inflate the air bags simultaneously.
4) Drive home the wedges with a mall.
5) Deflate the air bag and remove from the chock.

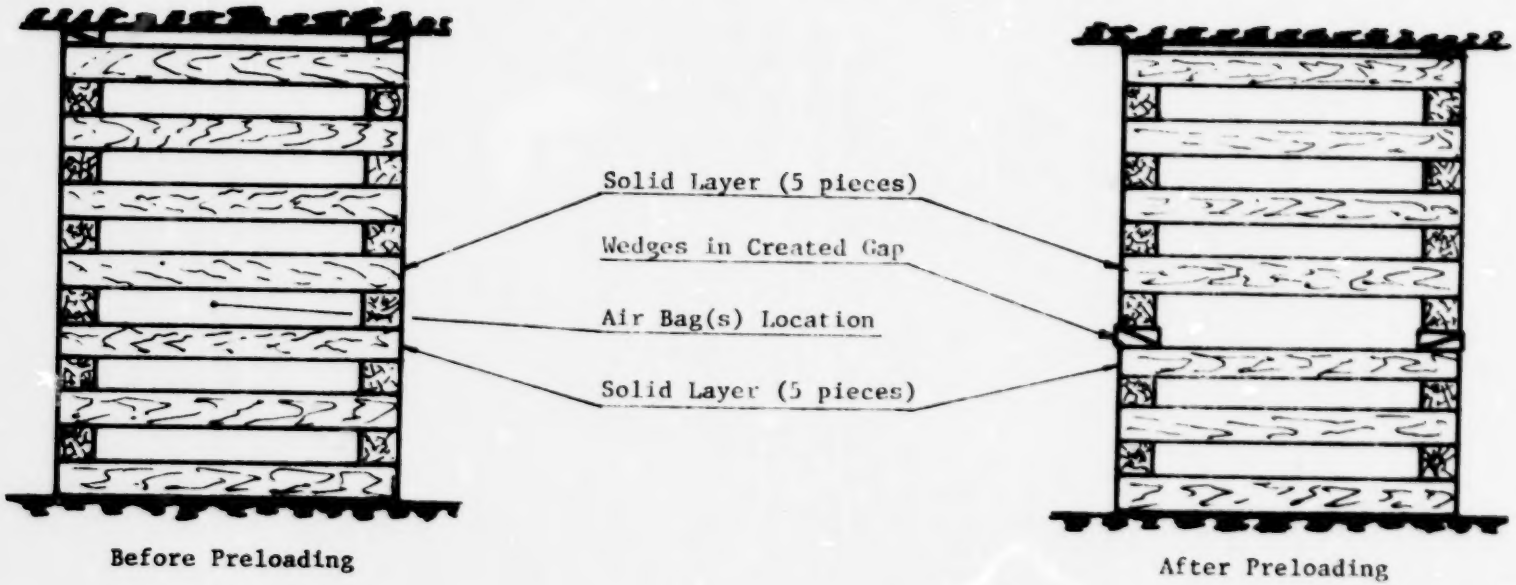

Figure B1 - Recommended method of building chock for preloading with air bags